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ABSTRACT

Assessment is an essential process for Physical Education program planning. This is especially true for children with special needs, such as children with Down Syndrome. The ultimate aim of assessments is to enable an informed and intelligent progam of planned activites. For children with Down Syndrome, there are no clear data on their overall motor performance nor is there a clear developmental picture. This paper will report the profile of strengths and weaknesses in the 8 sub-tests of the Bruininks Oseretsky Test (long form) for 27 children with Down Syndrome. The children ranged in age from 9 years 6 months to 13 years 8 months; mean age for the girls was 11 years 2 months, and for the boys, 11 years 4 months. The mean IQ for the girls was 53 and for the boys, 51. The children with Down Syndrome, with the exception of one boy, all live at home with their families. Three of the girls and two of the boys attend regular school, while the other girls and boys attend special schools. (Author/JD)

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Motor development in children with Down Syndrome

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ABSTRACT

TITLE: MOTOR DEVELOPMENT OF CHILDREN WITH DOWN SYNDROME

Assessment is an essential process for Physical Education program planning. This is especially true for children with special needs, such as children with Down Syndrome. The ultimate aim of assessments is to enable an informed and intelligent program of planned activities.

For children with Down Syndrome, there is no clear data on their overall motor performance nor is there a clear developmental picture (Reid, 1985).

This paper will report the profile of strengths and weaknesses in the 8 sub-tests of the Bruininks Oseretsky Test (long form), for 27 children [CA mean 11yr 3m, Std 1y 5m, MA mean 5yr 8m, Std 9m] (14 girls, 13 boys) with Down Syndrome. The children were aged between 9yrs 6mths and 13yrs 8mths; mean age for the girls was 11yrs 2mths [SD 1yr 2mths] and for the boys 11yrs 4mths [SD 1yr 8mths]. The mean IQ for the girls was 53 [SD 6] and for the boys was 51 [SD 9].

The children with Down Syndrome with the exception of 1 boy, all live at home with their families; and 3 of the girls and 2 of the boys attend regular school, while the other girls and boys attend special schools.

MOTOR DEVELOPMENT OF CHILDREN WITH DOWN SYNDROME

Introduction

The study of motor proficiency has long been a concern of persons interested in the development, education and habilitation of retarded persons (Bruininks, 1974). Motor proficiency is an important component in the development of the child. For the child with an intellectual disability, it also has an interactional role in therapeutic and educational programming.

It has been well documented (Henderson, et al., 1981; Henderson, 1985; Hogg, 1984; Frith & Frith, 1974; Anwar, 1981; Connolly, et al., 1986) that children with Down Syndrome have motor impairments and dysfunctions. Typically, the studies of their motor development have tended to cover into two main aspects of motor behaviour; investigations and reports of the age at which they have attained motor milestones (Carr, 1975, Berry et al., 1984) and the degree to which these deviate from those of the normally developing child (Share & French,1982; Lewis, 1987); and the investigations of the characteristics of their motor performance (Henderson, 1981; Kerr & Blais, 1985, 1987, 1988; Connolly, et al., 1984, 1986, Haley, 1986) and their individual differences.

Both these areas are important because if the motor development of child with Down syndrome is delayed or different to that of other children, there may be implications for other areas of development (Lewis, 1987).

Generally these studies have tended to suggest that they attain milestones and skills later than normally developing children (Share & French, 1982) and that there are elements of difference in both the rate and the pattern of that development (Frith & Frith, 1974; Lewis, 1987).

Within these two main areas of study, their motor milestones and characteristics of performance have been related to a variety of physical and health

aspects associated with the Syndrome. Physical developmental aspects such as muscular hypotonia (Reed, et al., 1980; Harris, 1984; Pueschel, et al., 1987; Davis & Scott-Kelso, 1982), the postural reactions - the emergence and retention of reflexes (Cowie,1970; Shumway-Cook et al., 1985; Haley,1987), gait (Parker & Bronks, 1980) and flexibility (Parker & James, 1985), are some of the issues discussed and researched. These studies have explored the relationships of the above factors to the attainment of motor milestones and/or their specific effects on the characteristics of their motor control and performance.

Health aspects such as orthopaedic disorders(Diamond et al., 1981), fitness (Seidl et al.,1987; Fernhall et al., 1989), obesity (Cronk et al., 1985; Burkart et al., 1985) and metabolic rate (Chad et al., 1989) have also be researched for an explanation to the milestone delays and or the characteristic differences in proficiency.

Further explanations for their characteristic delays and differences, using a motor learning research focus, have explored aspects such as spatial kinematic and temporal components of a task (Henderson, 1981), skills acquisition and the role of practice (Kerr & Blais, 1985, 1988), the deficits in motor programming (Frith & Frith, 1974) and aspects of visual-motor functioning (Anwar, 1981).

It is not the purpose of this paper to discuss these issues and their relationship to motor development of children with Down Syndrome except to note that more research is needed to settle and clarify these questions (Lewis, 1987; O'Brien & Hayes, 1989).

Henderson (in Lane et al., 1985) stated:

> *We are a long way from understanding the exact nature of the interaction between neuromotor organisation and the deficits in perceptual and cognitive functioning which cause the variety of different problems in executing motor acts ... and in particular how they change over time. (p. 213)*

The purpose of this study was to develop a clearer picture of the motor proficiency of children with Down Syndrome near adolescence. Little motor development research have focused on this age group using a standardized assessment profile. Much of the literature relates to younger children (Harris, 1981; Share & French, 1982) and tends to be descriptive and prescriptive within the context of motor programming in early intervention (Connolly et al., 1984; Haley, 1988). Also, attention has tended to focus on motor behaviour aspects and their remains an acknowledged lack of results from well-standardized tests (Henderson, 1981).

This paper will present some of the motor proficiency data from a longitudinal study of children with Down Syndrome who attend school in Brisbane.

The work presented represents only part of a broader longitudinal study of the development of children with Down Syndrome living in Brisbane, being undertaken at the Fred & Eleanor Schonell Special Education Research Centre, University of Queensland.

Method

The ultimate aim of assessment within the educational context is to enable an intelligent and informed program of planned activities to be developed. Assessments are carried out regularly on the children as well as the collection of family, temperament and schooling data.

For the children's motor assessments, the project has utilized the Bayley Scales of Motor Development and the Bruininks Oseretsky Test of Motor Proficiency. These assessments have generally been carried out annually. In this paper, a descriptive analysis of the motor proficiency of 27 children with Down syndrome is presented.

The Subject Description

There were 27 children with an age range of 9yr 6m to 13y 8m . (Boys N = 13: 9yr 6m to 13yr 8m; Mean 11y 4m; Std Dev. 1yr 8m;) (Girls N = 14: 9yr 7m to 12 yr 8m; Mean 11yr 2m; Std Dev. 1yr 2m). They were children who had been able to attain at least a basal age equivalent (i.e. 4yr 2m) on all eight sub-test items of the Bruininks Oseretsky.

Their mental ages were assessed using the Stanford-Binet L-M. The boys' mental ages (Thorndike, 1972 norms) ranged from 3yr9m to 6yr8m (mean 5yr2m, std dev. 10m) with IQ 36 to 64 (mean 52, Std dev 8) while the girls' ranged from 3yr11m to 6yr6m (mean 5yr, Std dev. 8m) with IQ 46 to 66 (mean 53, Std dev. 6).

They all attend school and were living in a family. Their general health was good at the time of the assessment.

The Approach

The motor proficiency of the children was assessed using the Bruininks Oseretsky which has standardization data available for children at 4, 8, and 12 years of age.

The Bruininks Oseretsky Test of Motor Proficiency (1978) comprises eight subtest areas, representing gross (1-4) and fine (6-8) motor development aspects. These can be calculated separately or be combined with an upper limb co-ordination subtest (5) to obtain a battery score. The test has a Long and Short Form. The Long Form scores are used for the purpose of this paper as it gave more specificity in motor proficiency than the generalized perceptive of the Short Form. The Bruininks-Oseretsky differentiates between normal and handicapped students in a manner consistent with that observed in similar comparative studies of motor development. This confirms the usefulness of the test as a measure of motor performance for retarded subjects (Manual, p.31). In agreement with

Connolly et al. (1986) the items in the Test were considered to be of interest to children, and the instructions and trials are useful in assessing the child's understanding of the task. Scoring utilizes several mediums: amount of time taken, number of units in a fixed time, number of errors in performing the task, and pass/fail on a prescribed task. This is also desirable, as the child with Down Syndrome is known to have difficulties in some assessments where time criterion are imposed (Henderson et al 1981).

Correlations were calculated between the age equivalent scores on the subtests, the gross and fine motor scores , the Battery composite score , C.A. and the Stanford Binet mental age.

Results

Table 1 shows the range and median subtest scores for boys and girls. There were no significant differences between boys and girls on any of the subtests or the composite scores.

Correlations were calculated between C.A., M.A. and the subtests. Three subtests (Bi-lateral Co-ordination (3), Upper Limb Co-ordination (5) and Upper Limb Speed and Dexterity (8) [$r=.45$, ($p<.025$); $r=.63$, ($p<.001$); $r=.42$, ($p<.05$) respectively] were significantly associated with C.A.

Of these only Bi-lateral Co-ordination was associated only with M.A. [$r=.44$, ($p<.025$). This association remained at significant level [$r=.59$ ($p<.01$)] when C.A. was partialled out. On the other hand the relationship between C.A. and Bi-Lateral Co-ordination was not significant when M.A. was partialled out.

The intercorrelations between the subtests is shown in Table 2. Significant associations between subtests for the children with Down syndrome were also significant for children of 4yrs (i.e. similar M.A. in the standardized sample); but

were not significant for children of 12 yrs (i.e. similar C.A. in the standardized sample), except the association between Balance (2) and Visual Motor Control (7).

Comparisons between the overall gross motor scores for two boys and two girls who are near the upper and lower IQ levels of the group were made on an overlay plot graph. This is presented in Table 3.

Discussion

Heterogeniety in the sample was high. This is consistent with the literature that reports intragroup variabilities in mental and motor age for a group of 1year old Australian and Canadian infants (Gunn & Berry, 1989) and variability in sensorimotor performance as reported by Dunst and Rheingrover (1983). A wide range of scores across the subtests is evident especially Upper-Limb Coordination (5) for boys and Visual-motor(7) for girls.

The Balance subtest results (2) present as a narrower range of scores and this may tend to suggest that there is less variability within the sample for this subtest than in others. Both boys and girls demonstrated, as reported in the literature (Le Blanc et al. 1977; Henderson, et al., 1981; Connolly & Michael, 1986), the low proficiency children with Down Syndrome have with this aspect of gross motor performance.

It is interesting to note that the two boys who were the most proficient in the gross motor battery were at the low and high ends of the IQ range. Although both M.A. and C. A. showed some association with various subtests, it is advisable to take care in using either IQ or M.A. as the sole indicator of programming requirements or settings (ie segregated or integrated) for activities. This concurs with the concerns of Anwar's (1981) about the use of M.A. per se as the total explanation for their lack of proficiency.

However, the significant association of Bi-Lateral Co-ordination (3) with M.A. needs further investigation as an influence in the gross motor aspect of the children's proficiency across a broader M.A. range.

Conclusion

Motor proficiency is a dynamic and malleable aspect of development and it is important to understand not only the physical changes that accompany growth and development but also how these relate to individual developmental variability within the syndrome. The label "Down Syndrome" often predisposes professionals and the community to certain expectations of potential and proficiency. As the data from this paper has demonstrated however, expectations without appropriate assessment may result in inappropriate programming. Individual variability and differences continue to confound the researchers and therefore assessment should become an essential process for P.E. programming and planning. Within the programming it is imperative that children with Down Syndrome should not be classified as one -- the Downsies!

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Thorndike, (1972)

Table 1

Bruininks Range and Median Scores

Sub Test	Boys n=13	Girls n=14
Run Agility(1)		
Range	5.92-8.92	4.67-8.92
Median	7.67	6.67
Balance(2)		
Range	4.17-5.42	4.17-5.17
Median	4.17	4.42
Bilat.Coord.(3)		
Range	4.42-7.42	4.42-6.92
Median	5.92	5.17
Strength(4)		
Range	4.92-6.67	4.67-6.67
Median	5.67	5.29
Upper L. Coord.(5)		
Range	5.17-10.42	4.67-8.42
Median	6.17	6.42
Response Sp.(6)		
Range	4.17-6.92	4.17-6.17
Median	4.92	4.92
Visual Motor(7)		
Range	4.92-8.92	5.17-9.17
Median	5.42	6.79
Up. L. Sp.& Dex(8)		
Range	4.92-8.92	5.42-7.42
Median	6.17	6.29
GrossMotorComposite (1-4)		
Range	5.00-6.67	4.42-6.00
Median	5.75	5.17
FineMotorComposite (6-8)		
Range	4.92-7.42	5.17-7.42
Median	5.67	5.79
BatteryComposite (1-8)		
Range	4.92-7.42	5.17-7.42
Median	5.75	5.58

Table 2

DOWN SYNDROME ASSOCIATIONS WITH INTERCORRELATIONS AMONG SUBTESTS

Subtest	Running Speed and Agility	Balance	Bilateral Coordination	Strength	Upper-Limb Coordination	Response Speed	Visual-Motor Control	Upper-Limb Speed and Dexterity
Gross Motor Subtests:								
Balance								
Bilateral Coordination	*							
Strength								
Gross and Fine Motor Subtest:								
Upper-Limb Coordination	*		**					
Fine Motor Subtests:								
Response Speed		*						
Visual-Motor Control		*		**				
Upper-Limb Speed and Dexterity			**					

* $p < .025$

** $p < .005$

All these associations were significant for the 4 year olds in the standardisation sample. Only one of them (between balance and visual-motor control) was significant for the 12-year standardization sample.

Table 3 **OVERLAY PLOTS : GROSS MOTOR SCORES (subtest 1-4)**